BELUGA WHALE (*Delphinapterus leucas*): Cook Inlet Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980), and are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988). Depending on season and region, beluga whales may occur in both offshore and coastal waters, with concentrations in Cook Inlet, Bristol Bay, Norton Sound, Kasegaluk Lagoon, and the Mackenzie Delta (Hazard 1988). Apparently most beluga whales from these summering areas overwinter in the Bering Sea, excluding those found in Cook Inlet (O'Corry-Crowe et al. 1997). Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human interaction (Lowry 1985). During the winter, beluga whales occur in offshore waters associated with pack ice. In the spring, many migrate to warmer coastal estuaries, bays, and rivers for molting (Finley 1982) and calving (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990, Suydam et al. 2001).

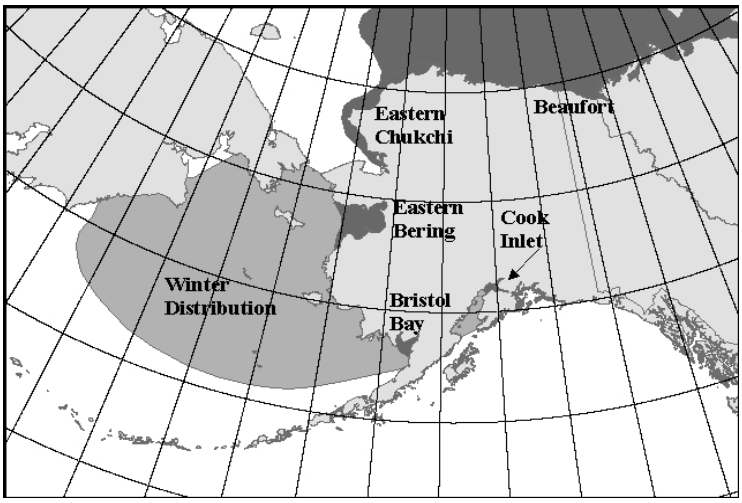

Figure 18. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distribution of the five stocks. Winter distributions are depicted with lighter shading.

During spring and summer months, beluga whales in Cook Inlet are typically concentrated near river mouths in northern Cook Inlet (Rugh et al. 2000). Although the exact winter distribution of this stock is unknown, there is evidence that some--if not all--of this population may inhabit Cook Inlet year-round (Hansen and Hubbard 1999, Rugh et al. 2000). Satellite tags have been attached to ~~nine~~seventeen belugas in late summer in order to determine their distribution through the fall and winter. ~~Of these, six~~ Ten tags have lasted through the fall and ~~one lasted into March~~ of those, three have lasted through the winter. The two tags that transmitted through the winter stopped working in April and late May. No~~ne~~ tagged beluga have gone south of Chinitna Bay. A review of all cetacean surveys conducted in the Gulf of Alaska from 1936-00 discovered only 31 sightings of belugas among 23,000 sightings of other cetaceans, indicating that very few belugas occur in the Gulf of Alaska outside of Cook Inlet (Laidre et al. 2000). A small number of beluga whales (under 20 animals) also occur at least seasonally in Yakutat Bay; these are considered part of the Cook Inlet stock (65 FR 34590; 31 May 2000) and have been shown to be closely related genetically (NMFS unpublished data).

The following information was considered in classifying beluga whale stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution discontinuous in summer (Frost and Lowry 1990); distribution unknown outside of summer; 2) Population response data: possible extirpation of local populations; distinct population trends between regions occupied in summer; 3) Phenotypic data: unknown; and 4) Genotypic data: mitochondrial DNA analyses indicate distinct differences among summering areas (O'Corry-Crowe et al. 1997, 2002). Based on this information, 5 stocks of beluga whales are recognized within U. S. waters: 1) Cook Inlet, 2) Bristol Bay, 3) eastern Bering Sea, 4) eastern Chukchi Sea, and 5) Beaufort Sea (Fig. 18).

POPULATION SIZE

Aerial surveys for beluga whales in Cook Inlet have been conducted by the National Marine Fisheries Service each year since 1993. Starting in 1994, the survey protocol included paired, independent observers so that the number of whale groups missed can be estimated. When groups were seen, a series of aerial passes were made to allow each observer to make independent counts at the same time that a video camera was documenting the whale group (Rugh et al. 2000).

The annual abundances of beluga whales in Cook Inlet are estimated from counts by aerial observers and aerial video group counts. Each group size estimate is corrected for subsurface animals (availability correction) and animals at the surface that were missed (sightability correction) based on an analysis of the video tapes (Hobbs et al. 2000b). ~~Each~~When video counts are not available, observer's counts are corrected for availability and sightability using a regression of counts and an interaction term of counts with encounter rate against the video group size estimates (Hobbs et al. 2000b). The most recent abundance estimate of beluga whales in Cook Inlet, resulting from the June 200~~1~~2 aerial survey is 3~~86~~13 (CV = 0.~~087~~12) animals (NMFS unpubl. data). Although the 200~~1~~2 estimate of abundance is ~~slightly~~ lower than the estimates for 2000 and 2001, the difference is not significant and is not believed to represent a decline in the population (NMFS unpublished data).

Minimum Population Estimate

The minimum population size (N_{MIN}) for this stock is calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of ~~386~~313 and its associated CV(N) of 0.~~087~~12, N_{MIN} for the Cook Inlet stock of beluga whales is ~~359~~283.

Current Population Trend

~~In general, uncorrected counts have ranged from 300 to 500 beluga whales within Cook Inlet between 1970 and 1996 (Rugh et al. 2000). However, median counts since 1996 have been below 300 animals (264 in 1997, 193 in 1998, 217 in 1999, and 184 in 2000).~~ The corrected abundance estimates for the period 1994-~~00~~02 are shown in Figure 19. A statistically significant trend in abundance was detected between 1994 and 1998 (Hobbs et al. 2000a), although the power was low due to the short time series. However, the 1998 abundance estimate (349) was approximately 50% lower than the 1994 abundance estimate (653). ~~In addition, a review of beluga distribution data over the past three decades shows there has been a reduction in offshore sightings in upper Cook Inlet and a dramatic reduction in sightings in lower Cook Inlet (Rugh et al. 2000).~~ Since 1998, this decline seems to have stopped (Hobbs et al. 2000a). Although the 2002 abundance estimate is the lowest to date the recent apparent trend is not significantly different from zero. In addition, a review of beluga distribution data over the past three decades shows there has been a reduction in offshore sightings in upper Cook Inlet and a dramatic reduction in sightings in lower Cook Inlet (Rugh et al. 2000).

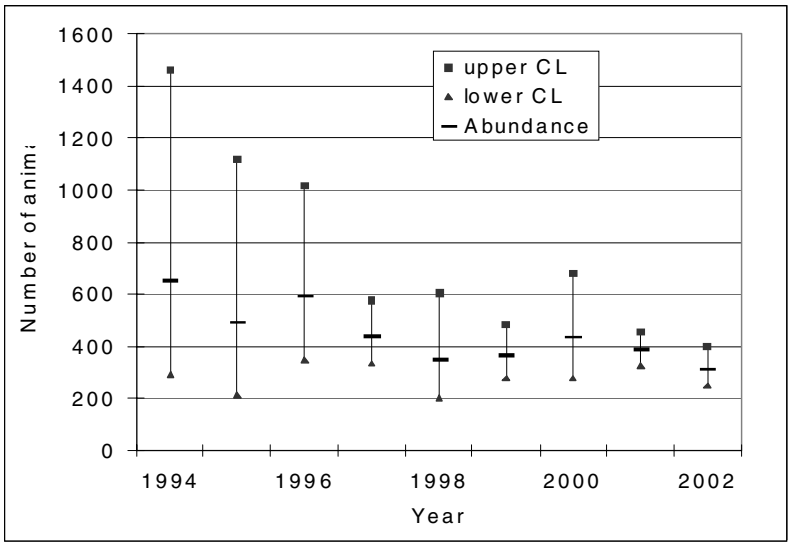

Figure 19. Abundance of beluga whales in Cook Inlet, Alaska 1994-200~~0~~2. Error bars depict 95% confidence intervals.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently not available for the Cook Inlet stock of beluga whales. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The F_R and PBR for the Cook Inlet stock of beluga whale were both undetermined in Small and DeMaster (1995), 1.0 and 15 in Hill et al. (1997), and 1.0 and 14 in Hill and DeMaster (1998). However, based on the recent information on stock size, trends in abundance, and level of the subsistence

harvest, the Alaska Scientific Review Group (SRG) (Ferrero 1999) has recommended that NMFS reduce the F_R to the lowest value possible (0.1). Further, the Alaska SRG noted the resulting PBR would be 0.61 (assuming an N_{MIN} of 303 as the 1999 population size and an R_{MAX} of 0.04) and recommended that the agency use this value in managing interactions between Cook Inlet belugas and commercial fisheries in Cook Inlet.

NMFS has chosen not to accept the recommendation of the Alaska SRG at this time. Rather, NMFS has selected an F_R of 0.3 based on the following: this stock has been listed as "depleted" under the MMPA (65 Federal Register 34590, 31 May 2000; which typically is associated with a F_R of 0.5); and NMFS has not listed this stock as endangered under the Endangered Species Act (65 Federal Register 38778, 22 June 2000; a listing of endangered is typically associated with a F_R of 0.1, while a listing of depleted or threatened is associated with a F_R of 0.5). Furthermore, the major mortality factor for this stock, subsistence harvest, has been reduced through legislation and cooperative efforts by Alaskan Natives. Thus, the PBR = ~~2.2~~1.7 animals (~~359~~283 × 0.02 × 0.3) for the Cook Inlet stock of beluga whale.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

In 1999 and 2000, observers were placed on Cook Inlet salmon set and drift gillnet vessels because of the potential for these fisheries to incur incidental mortalities of beluga whales. No mortalities were observed in either year (Merkelein et al., in review). An additional source of information on the number of beluga whales killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the period between 1990-00, fisher self-reports indicated no mortalities of beluga whales from interactions with commercial fishing operations (Table 17a). Logbook data are available for part of 1989-94, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-95 phase-in period is fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 for details).

Table 17a. Summary of incidental mortality of beluga whales (Cook Inlet stock) due to commercial fisheries for 1999-2001.

Fishery name	Years	Data type	Range of observer coverage	Reported mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Cook Inlet salmon drift gillnet	99-00	obs data		0, 0	0	0
Cook Inlet salmon set gillnet	99-00	obs data		0, 0	0	0
Observer program total	93-99					0
Minimum total annual mortality						0

Based on a lack of reported mortalities, the estimated minimum mortality rate incidental to commercial fisheries is zero belugas per year from this stock.

Subsistence/Native Harvest Information

Subsistence harvest of beluga whales in Cook Inlet has been important to local villages. Between 1993 and 1999, the subsistence take ranged from 30 animals to over 100 (Mahoney and Shelden 2000). The most thorough subsistence harvest surveys were completed by the Cook Inlet Marine Mammal Council during 1995-97; while some of

the hunters believe the 1996 estimate was positively biased, the 1995-97 CIMMC take estimates are considered reliable. The average annual subsistence harvest between 1995 and 1997 was 87 whales.

Congress imposed a moratorium on beluga harvest in Cook Inlet because of the decline in the Cook Inlet beluga whale stock until NMFS developed a cooperative plan for harvest management with the local Alaska Native organizations. Thus, the best estimate of subsistence take in 1999 and 2000 is zero. Harvest is now conducted under a comanagement agreement between the Alaska Native organizations and NMFS; under that agreement, one whale taken in both 2001 and 2002. A summary of Cook Inlet beluga whale subsistence harvest data for 1999-01 is provided in Table 17b.

Table 17b. Summary of the Alaska Native subsistence harvest from the Cook Inlet stock of beluga whales, 1999-2001. n/a indicates the data are not available.

Year	Reported total number taken	Estimated range of total take	Reported number harvested	Estimated number struck and lost
1999	0	0	0	0
2000	0	0	0	0
2001	1	-	1	0
2002	1	-	1	0
Mean annual take, 2001-02	1			

[1] Estimated value (see text); [2] Represents a minimum value.

OTHER MORTALITY

Mortalities ~~realted~~related to stranding events have been reported in Cook Inlet (Table 17c). Since detailed recordkeeping was initiated in 1994, there have been mass strandings of beluga almost every year. These mass strandings resulted in mortalies of 4 animals in 1996 and 5 animals in 1999 (NMFS unpublished data). ~~In August 1996, 60 beluga whales stranded in Turnagin Arm and four of these animals are known to have died as a result of the stranding event (Moore et al. 2000). In September 1996, 20-30 beluga stranded in Turnagin Arm and one animal died. In August 1999, at least 60 beluga whales stranded in Turnagain Arm, of which five were subsequently found dead (Moore et al. 2000).~~ Many of these strandings occurred in Turnagin Arm; ~~B~~because Turnagin Arm is a shallow, dangerous waterway, it is not frequented by motorized vessels; thus, it is highly unlikely that the strandings resulted from human interactions. Another source of mortality in Cook Inlet is killer whale predation. Killer whale sightings were rare in the Upper Inlet prior to the 1990's, but have increased to include 18 confirmed sightings from 1985 to 2002 (Shelden et al. 2003). Recently, two predation events occurred in the Upper Inlet: one in September 1999 in which the outcome was unknown and one in September 2000 that involved two lactating

Table 17c. Cook Inlet beluga strandings investigated by NOAA Fisheries

Year	Total Dead (includes subsistence)	Natural or Unknown Cause	Mass Stranding (Mortality)
1994	10	7	186 (0)
1995	12	1	
1996	19	11	63(0), 60(4), 25(0), 10 (0)
1997	6	3	
1998	21	7	30(0), 5(0)
1999	13	13	60(5), 13(0)
2000	13	13 (2 killer whale)	8(0), 15-20(0), 1-2(0)
2001	11	10	
2002	14	13	
Total	119	78	476-482 (9)

females which subsequently died (Shelden at al. 2003).

STATUS OF STOCK

An analysis of available data on the population size and dynamics of the Cook Inlet beluga whale stock led NMFS to conclude that this stock is currently below it's Optimum Sustainable Population level. Thus, this stock was designated as "depleted" under the MMPA (65 FR 34590; 31 May 2000). NMFS also made a determination that this stock should not be listed under the ESA at this time (65 FR 38778; 22 June 2000) primarily because the subsistence harvest, which appears to have been responsible for the majority of the decline in this stock, was prohibited in 1999 through an act of Congress. Preliminary results indicate that, once the subsistence harvest ceased, the decline in the stock ceased (65 FR 38778; 22 June 2000, Hobbs et al. 2000a). In addition, NMFS and local subsistence organizations are actively pursuing the development of a co-management agreement which would allow subsistence harvest, but at a level far below historical levels. Two fisheries suspected of possibly incurring incidental serious injuries or mortalities of beluga whales were observed in 1999 and 2000, but no takes of beluga whales were observed. At present, annual commercial fishery-related mortality levels can be considered insignificant and approaching zero mortality and serious injury rate. In addition, based on the level of subsistence harvest in 1999 and the fact that there is currently a moratorium on the harvest, the total level of human-caused mortality does not exceed the PBR (1.8) level for this stock. However, because the Cook Inlet beluga whale stock has been designated as "depleted" under the MMPA, the Cook Inlet beluga whale stock is classified as strategic.

Efforts to develop co-management agreements with Native organizations for several marine mammal stocks harvested by Native subsistence hunters across Alaska, including belugas in Cook Inlet, have been underway for several years. In 1995, development of an umbrella agreement among the Indigenous People's Council for Marine Mammals, U.S. Fish and Wildlife Service, and NMFS was initiated. The agreement was ultimately signed in August 1997. During 1998, efforts were initiated to formalize a specific agreement with local Alaska Native organizations and NMFS regarding the management of Cook Inlet belugas, but without success. In the absence of a co-management agreement, Federal legislation was implemented in May 1999, placing a moratorium on beluga hunting in Cook Inlet until a co-management agreement is completed. Comanagement agreements between NMFS and the Cook Inlet Marine Mammal Council have since been signed in 2000, 2001, and 2002.

Habitat Concerns

NMFS recognizes that municipal, commercial, and industrial activites may be of concern and may affect the water quality and substrate in Cook Inlet. This includes commercial fishing, oil and gas development, municipal discharges, noise for aircraft and ships, shipping traffic, and tourism (Moore et al. 2000). However, no indication currently exists that these activities have had a quantifiable adverse impact on the beluga whale population. The best available information indicates that these activities, alone or cumulatively, have not caused the stock to be in danger of extinction (65 FR 38778; 22 June 2000;). Protection from industrial development is being provided at most locations where beluga whales commonly occur. However, susceptibility to adverse impacts may be greater now than previously because the stock, in its currently reduced state, occupies a more restricted portion of its prior range in Cook Inlet.

CITATIONS

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conserv. Biol. 6:24-36.

Ferrero, R. C. 1999. Minutes from the tenth meeting of the Alaska Scientific Review Group, 6-8 October 1999, Juneau, Alaska. 42 p. (available upon request - National Marine Mammal Laboratory, 7600 Sand Point Way, NE, Seattle, WA 98115)

Finley, K. J. 1982. The estuarine habitat of the beluga or white whale, *Delphinapterus leucas*. Cetus 4:4-5.

Frost, K. J., and L. F. Lowry. 1990. Distribution, abundance, and movements of beluga whales, *Delphinapterus leucas*, in coastal waters of western Alaska. Pp. 39-57, *In* T. G. Smith, D. J. St. Aubin, and J. R. Geraci (eds.), Advances in research on the beluga whale, *Delphinapterus leucas*. Can. Bull. Fish. Aquat. Sci. 224.

Gurevich, V. S. 1980. Worldwide distribution and migration patterns of the white whale (beluga), *Delphinapterus leucas*. Rep. Int. Whal. Comm. 30:465-480.

Hansen, D. J., and J. D. Hubbard. 1999. Distribution of Cook Inlet beluga whales (*Delphinapterus leucas*) in winter. Final Rept. OCS Study. MMS 99-0024. U.S. Dept. Int., Minerals Management Serv. Alaska OCS Region, Anchorage, AK. v. p.

Hazard, K. 1988. Beluga whale, *Delphinapterus leucas*. Pp. 195-235, *In* J. W. Lentfer (ed.), Selected marine mammals of Alaska. Species accounts with research and management recommendations. Marine Mammal Commission, Washington, D.C.

Hill, P. S., D. P. DeMaster, and R.J. Small (eds.) 1997. Alaska marine mammal stock assessments, 1996. U. S. Dept. Commer., NOAA Tech. Memo. NMFS-AFSC-78. 150pp.

Hill, P. S. and D. P. DeMaster (eds.) 1998. Alaska marine mammal stock assessments, 1998. U. S. Dept. Commer., NOAA Tech. Memo. NMFS-AFSC-97. 166pp.

Hobbs, R. C, D. J. Rugh, and D. P. DeMaster. 2000a. Abundance of belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska, 1994-2000. Mar. Fish. Rev. 62(3):37-45.

Hobbs, R.C., J.M. Waite, and D.J. Rugh. 2000b. Beluga, Delphinapterus leucas, group sizes in Cook Inlet, Alaska, based on observer counts and aerial video. Mar. Fish. Rev. 62(3):46-59.

Laidre, K. L., K. E. W. Shelden, D. J. Rugh, and B. Mahoney. 2000. Beluga, *Delphinapterus leucas*, distribution and survey effort in the Gulf of Alaska. Mar. Fish. Rev. 62(3):27-36.

Lowry, L. F. 1985. The belukha whale (*Delphinapterus leucas*). Pp. 3-13, *In* J. J. Burns, K. J. Frost, and L. F. Lowry (eds.), Marine mammals species accounts. Alaska Dep. Fish and Game, Game Tech. Bull. 7.

Mahoney, B. A. and K. E. W. Shelden. 2000. Harvest history of belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska. Mar. Fish. Rev. 62(3):124-140.

Merkelein, M., B. Fadely, and A. S. VanAtten. In review. Marine Mammal Protection Act observer program, Cook Inlet, Alaska.

Moore, S. E., K. E. Shelden, L. K. Litzky, B. A. Mahoney, and D. J. Rugh. 2000. Beluga whale, *Delphinapterus leucas*, habitat associations in Cook Inlet, Alaska. Mar. Fish. Rev. 62(3):60-80.

O'Corry-Crowe, G. M., R. S. Suydam, A. Rosenberg, K. J. Frost, and A. E. Dizon. 1997. Phylogeography, population structure and dispersal patterns of the beluga whale *Delphinapteras leucas* in the western Nearctic revealed by mitochondrial DNA. Mol. Ecol. 6:955-970.

O'Corry-Crowe, G. E., A. E. Dizon, R. S. Suydam, and L. F. Lowry. 2002. Molecular genetics studies of population structure and movement patterns in a migratory species: The beluga whale, Delphinapterus leucas, in the western nearctic. pp 464. In C. J. Pfeiffer (ed.), Molecular and cell biology of marine mammals. Kreiger Publishing Company. Malabar, Florida.

Reeves, R. R. 1990. An overview of the distribution, exploitation and conservation status of belugas, worldwide. Pp. 47-58, *In* J. Prescott and M. Gauquelin (eds.), For the future of the beluga: Proceedings of the International Forum for the Future of the Beluga. Univ. Quebec Press, Canada.

Rugh, D. J., K. E. W. Shelden, and B. Mahoney. 2000. Distribution of beluga whales in Cook Inlet, Alaska, during June/July, 1993 to 1999. Mar. Fish. Rev. 62(3):6-21.

Sergeant, D. E., and P. F. Brodie. 1969. Body size in white whales, *Delphinapterus leucas*. J. Fish. Res. Bd. Can. 26:2561-2580.

Shelden, K. E. W., D. J. Rugh, B. A. Mahoney, and M. E. Dahlheim. 2003. Killer whale predation on belugas in Cook Inlet, Alaska: Implications for a depleted population. Mar. Mammal Sci. 19(3):529-544.

Small, R.J. and D. P. DeMaster (eds.) 1995. Alaska marine mammal stock assessments, 1995. U. S. Dept. Commer., NOAA Tech. Memo. NMFS-AFSC-57. 93pp.

Stanek, R. T. 1994. The subsistence use of beluga whale in Cook Inlet by Alaska Natives, 1993. Draft Final Rep. Study No. 50ABNF200055, submitted to NMFS by Alaska Dep. Fish and Game, Juneau, AK. 24 pp.

Suydam, R.S., L.F. Lowry, K.J. Frost, G.M. O'Corry-Crowe, and D. Pikok,Jr. 2001. Satellite tracking of eastern Chukchi Sea beluga whales into the Arctic Ocean. Arctic 54(3):237-243.

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

HUMPBACK WHALE (*Megaptera novaeangliae*):
Western North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The humpback whale is distributed worldwide in all ocean basins, though it is less common in Arctic waters. In winter, most humpback whales occur in the temperate and tropical waters of the North and South Hemispheres (from 10°-23° latitude). Humpback whales in the high latitudes of the North Pacific are seasonal migrants that feed on zooplankton and small schooling fishes ~~in the cool, coastal waters of the western United States, western Canada, and the Russian Far East~~ (NMFS 1991). The historic feeding range of humpback whales in the North Pacific encompassed coastal and inland waters around the Pacific Rim from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Nemoto 1957, Tomlin 1967, Johnson and Wolman 1984). ~~These recent sightings clearly demonstrate that the Bering Sea remains an important feeding area.~~ Humpback whales have been known to enter the Chukchi Sea (Johnson and Wolman 1984). The humpback whale population in much of this range was considerably reduced as a result of intensive commercial exploitation during the 20th century.

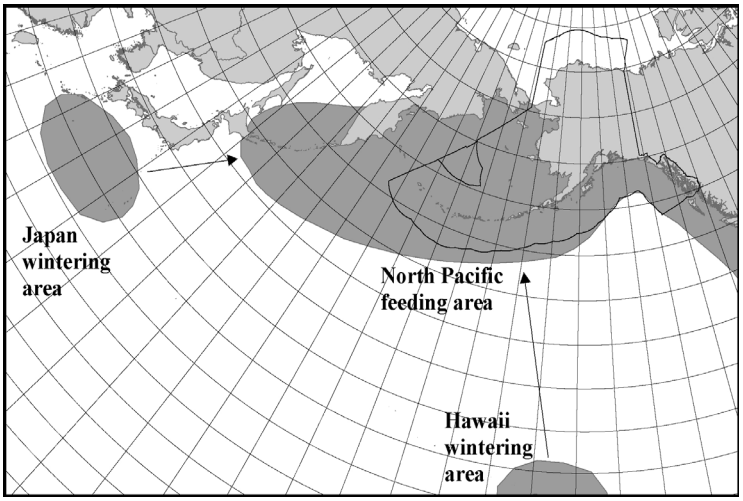

Figure 33. Approximate distribution of humpback whales in the western North Pacific (shaded area). Feeding and wintering grounds are presented above (see text). See Figure 34 for humpback whale distribution in the eastern North Pacific.

Recent surveys in the central-eastern and southeastern Bering Sea in 1999 and 2000 resulted in new information about the distribution of humpback whales in these areas (Moore et al. 2002). The only sightings of humpback whales in the central-eastern Bering Sea was southwest of St. Lawrence Island; animals co-occurred with a group of killer whales and a large aggregation of Arctic cod. A few sightings occurred in the southeast Bering Sea, primarily outside Bristol Bay and north of the eastern Aleutian Islands (Moore et al. 2002). These recent sightings clearly demonstrate that the Bering Sea remains an important feeding area.

Aerial, vessel, and photo-identification surveys and genetic analyses indicate that within the U. S. Exclusive Economic Zone (EEZ) there are at least three ~~relatively separate~~ populations that migrate between their respective summer/fall feeding areas to winter/spring calving and mating areas (Calambokidis et al. 1997, Baker et al. 1998, Figs. 33 and 34): 1) winter/spring populations in coastal Central America and Mexico which migrate to the coast of California to southern British Columbia in summer/fall (Calambokidis et al. 1989, Steiger et al. 1991, Calambokidis et al. 1993) - referred to as the California/Oregon/Washington and Mexico stock; 2) winter/spring populations of the Hawaiian Islands which migrate to northern British Columbia/Southeast Alaska and Prince William Sound west to Unimak Pass~~Kodiak~~ (Baker et al. 1990, Perry et al. 1990, Calambokidis et al. 1997) - referred to as the Central North Pacific stock; and 3) winter/spring populations of Japan which, based on Discovery ~~Tag~~Mark information, probably migrate to waters west of ~~the Kodiak Archipelago~~Unimak Pass (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991) - referred to as the Western North Pacific stock. Winter/spring populations of humpback whales also occur near Mexico's offshore islands in the Revillagigdeo Archipelago. The migratory destination of these whales is not well known (Calambokidis et al. 1993, Calambokidis et al. 1997), although whales from the the Revillagigdeo Archipelago have been matched to animals seen off of mainland Mexico, Hawaii, and Alaskan waters (S. Mizroch, North Pacific Humpback Whale Working Group, unpublished data). Some recent exchange between winter/spring areas has been documented (Darling and McSweeney 1985, Baker et al. 1986, Darling and Cerchio 1993), as well as movement between Japan and British Columbia, and Japan and the Kodiak Archipelago (Darling et al. 1996,

Calambokidis et al. 1997).

Currently, there are insufficient data to apply the Dizon et al.(1992) phylogeographic approach to classify population structure in humpback whales. Until further information becomes available, three stocks of humpback whales (as described above) are recognized within the U.S. EEZ of the North Pacific: one in the Eastern North Pacific (the California/Oregon/Washington - Mexico stock), one in the Central North Pacific, and one in the Western North Pacific. The California/Oregon/Washington - Mexico humpback whale stock is reported separately in the Stock Assessment Reports for the Pacific Region.

Available information about feeding areas in U.S. waters for the western stock of humpback whales indicates that there is considerable overlap between the western North Pacific and central North Pacific stocks in the Gulf of Alaska between Kodiak Island and the Shumagin Islands. ~~Little is known about the feeding areas located in U.S. waters for the western North Pacific humpback whale stock. There has only been one study designed to photo-identify individual animals in the North Pacific waters west of the Kodiak Archipelago (Waite et al. 1999).~~ Over 3 years, Waite et al (1999) ~~this study~~ collected photographs of 127 individuals located near Kodiak Island, 22 individuals located near the Shumagin Islands, 8 individuals located offshore to the southeast of the Shumagin Islands, and 7 individuals located near Akutan Island in the eastern Aleutian Islands. Only 7 of these individuals have been documented in Prince William Sound or Southeast Alaska. Witteveen (2003a) conducted a photo-identification study in Marmot and Chiniak Bays (on the northeast side of Kodiak Island), documented 103 individual animals, and estimated that the number of humpback whales in that area totaled 157 (95% CI: 114, 241). ~~Waite et al. (1999) provide strong evidence that the waters around Kodiak support a discrete feeding aggregation, and it is unknown where these whales spend the winters.~~ Witteveen and Straley (2002) report matches between whale photographed at the Shumagin Is between 1999-02 and whales photographed in Hawaii, offshore Mexico Islands, coastal Mexico waters, and Japan. ~~The lack of effort in the waters west of the Kodiak Archipelago is likely responsible for the fact that none of the whales identified off Japan have been resighted in the historical feeding areas of the stock (Bering Sea and Aleutian Islands).~~ In addition, ~~I~~individuals identified off Japan~~, however,~~ have been resighted in the eastern North Pacific (Darling et al. 1996, Calambokidis et al. 1997). ~~This may indicate that the western North Pacific humpback whale stock did not exclusively use the feeding areas in the western Pacific, or that a shift in the migratory destination of this stock has occurred. Thus, some unknown fraction of whales from the wintering grounds off Japan spend their summers feeding in areas typically utilized by whales from the central North Pacific stock.~~ Finally, there is at least one case of an animal photographed in the Bering Sea, which is traditionally considered the feeding grounds for the population which winters off Japan, being photographed in Hawaii (S. Mizroch, North Pacific Humpback Whale Working Group, unpublished data).

In summary, new information from a variety of sources indicates that humpback whales from the western and Central North Pacific stocks mix on summer feeding grounds in the central Gulf of Alaska and perhaps the Bering Sea. A major research effort was initiated in 2002 in order to better delineate stock structure of humpback whales in the North Pacific using a variety of techniques, and it is expected that this effort will assist in resolving stock structure within a few years.

POPULATION SIZE

The abundance estimate of humpback whales in the North Pacific is based on data collected by nine independent research groups that conducted photo-identification studies of humpback whales in the three wintering areas (Mexico, Hawaii, and Japan). Photographs taken between 1991 and 1993 were used to estimate abundance because samples throughout the entire North Pacific were the largest and most complete during this period. Using Darroch's (1961) method, which utilizes only data from wintering areas (in this case data provided by two Japanese research groups), and averaging the 1991-92, 1992-93, and 1991-93 winter release-recovery information results in an abundance estimate of 394 (CV = 0.084) for the Western North Pacific humpback whale stock (Calambokidis et al. 1997).

A vessel survey conducted in August of 1994 covered 2,050 nautical miles of trackline south of the Aleutian Islands encountered humpback whales in scattered aggregations (57 sightings) throughout the study area (Forney and Brownell 1996). It is unknown whether the humpback whales encountered during this survey belonged to the Western or Central North Pacific stock.

A vessel survey for cetaceans was conducted in the central Bering Sea in July-August 1999 in cooperation with research on commercial fisheries (Moore et al. 2000). The survey included 6,043 nmi of tracklines, most of which were West of St. Matthew Island, north of the 200m bathymetric contour, and south of the U.S./Russia Convention Line. Ten on-effort sightings of humpback whales occurred during this survey, the majority of which took place along the eastern Aleutian chain and near the U.S./Russian Convention Line just south of St. Lawrence Island. If these localized sightings

are extrapolated to the entire survey area, an estimated abundance of 1,175 humpback whales (95% CI 197-7,009) occur in the central Bering Sea during the summer. However, Moore et al. (2002) determined that these sightings were too clumped in the central-eastern Bering Sea to be used to provide a reliable estimate for the area and decided to improve upon the method used to stratify the data in the analysis. Sightings of humpback whales also occurred during the survey conducted in the eastern Bering Sea in 2000; these sightings resulted in an estimated abundance of 102 (95% CI = 40-262). It is unknown whether these animals belong to the central or western North Pacific stock of humpback whales.

Photo-identification studies initiated to the west of Kodiak Island in 1999 have identified approximately 350 individual humpback whales, and matches between these animals and animals documented in Hawaii, Japan and Mexico have occurred (~~B. Witteveen, unpublished report~~Witteveen 2003b). It is not known how many animals occurring to the west of Kodiak Island belong to the western or central North Pacific stock, but matches between animals photographed near Kodiak and animals photographed in Hawaii, offshore Mexico, coastal Mexico, and Japan clearly indicate that overlap between stocks occurs in this area (Witteveen and Straley 2002; S. Mizroch, North Pacific Humpback Whale Working Group, unpublished data).

There are no reliable estimates for the abundance of humpback whales at feeding areas for this stock because ~~the specific feeding areas are largely unknown~~surveys of the known feeding areas are incomplete, and because not all feeding areas are known.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 394 and its associated CV(N) of 0.084, N_{MIN} for this humpback whale stock is 367.

Current Population Trend

Reliable information on trends in abundance for the western North Pacific humpback whale stock are currently not available.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Utilizing a birth-interval model, Barlow and Clapham (1997) have estimated a population growth rate of 6.5% (SE = 1.2%) for the well-studied humpback whale population in the Gulf of Maine. However, there are no estimates of the growth rate of humpback whale populations in the North Pacific (Best 1993). Hence, until additional data become available from this or other North Pacific humpback whale stocks, it is recommended that the cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the value for cetacean stocks listed as endangered under the Endangered Species Act (Wade and Angliss 1997). Thus, for the Western North Pacific stock of humpback whale, PBR = 0.7 animals (367 × 0.02 × 0.1).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating in Alaska waters within the range of this stock were monitored for incidental take by fishery observers during 1990-200~~0~~2: Bering Sea/Aleutian Islands groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. One humpback whale mortality was observed in the Bering Sea/Aleutian Islands groundfish trawl fishery during both 1998 and 1999. Average annual mortality from observed fisheries was 0.~~6~~8 humpbacks from this stock (Table 26). Note, however, that the stock identification is uncertain and the mortality may have been attributable to the central North Pacific stock of humpback whales. Thus, this mortality is assigned to both the central and western stocks.

An additional source of information on the number of humpback whales killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the period between 1990 and 200~~1~~2, there were no fisher self-reports of humpback whale injuries or mortalities

from interactions with commercial fishing gear in any Alaska fishery within the presumed range of the Western North Pacific humpback whale stock. Logbook data are available for part of 1989-94, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-95 phase-in period is fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 for details).

Strandings of humpback whales entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. The only fishery-related humpback stranding in an area thought to be occupied by animals from this stock was reported by a U. S. Coast Guard vessel in late June 1997 operating near the Bering Strait. The whale was found floating dead entangled in netting and trailing orange buoys (National Marine Mammal Laboratory, Platforms of Opportunity Program, unpubl. data, 7600 Sand Point Way NE, Seattle, WA 98115). With the given data it is not possible to determine which fishery (or even which country) caused the mortality. Note, that this mortality has been attributed the Western North Pacific stock, but without a tissue sample (for genetic analysis) or a photograph (for matching to known Japanese animals) it is not possible to be for certain (i.e., it may have belonged to the Central North Pacific stock). ~~Averaging this mortality over the 5-year period 1994-99 results in an estimated annual mortality of 0.2 humpback whales from this stock. This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found, or reported~~ No strandings occurred between 1998 and 2002.

Table 26. Summary of incidental mortality of humpback whales (western North Pacific stock) due to commercial fisheries from 1990-200~~1~~2 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate. For a particular fishery, the most recent 5 years of available data are used in the mortality calculation when more than 5 years of data are provided. *The humpback whale ~~mortality~~mortalities from 1998 and 2002 ~~was~~were seen by an observer but not during an "observed set"; thus quantification of effort cannot be accomplished and the single record cannot be extrapolated to provide a total estimated mortality level. n/a indicates that data are not available.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSAI) groundfish trawl	9~~7~~8-0~~1~~2	obs data	62-77%	0 0 1 0 0	0 1* 1 0 0	0.6 (CV = 0.44)
Bering Sea/Aleutian Is. pot	98-02	obs data	13.6% average over 5 yrs	0 0 0 0 0	0 0 0 0 1*	0.2
Observer program total						0.6~~8~~
				Reported mortalities		
Unknown fishery (Bering Sea)	94-0~~1~~2	strand data	n/a	0, 0, 0 1 0 0 0 0	≥0.2	[≥0.2]
Minimum total annual mortality						[≥~~0.8~~1.0]

The estimated annual mortality rate incidental to commercial fisheries is 0.8 (0.~~6~~8 from observed fisheries ~~plus 0.2 from the stranding data~~) whales per year from this stock. However, this estimate is considered a minimum because

there are no data concerning fishery-related mortalities in Japanese, Russian, or international waters. In addition, there is a small probability that fishery interactions discussed in the assessment for the Central North Pacific stock may have involved animals from this stock because the only known matches to feeding areas come from areas typically used by the Central North Pacific stock. Finally, much information on fishery interaction with the Central North Pacific stock is based on information reported to the Alaska Region as stranding data. However, very few stranding reports are received from areas west of Kodiak.

Brownell et al. (2000) compiled records of bycatch in Japanese and Korean commercial fisheries between 1993 and 2000. During the period 1995-99, there were six humpback whales indicated as "bycatch". In addition, two strandings were reported during this period. Furthermore, analysis of four samples from meat found in markets indicated that humpback whales are being sold. At this time, it is not known whether any or all strandings were caused by incidental interactions with commercial fisheries; similarly, it is not known whether the humpback whales identified in market samples were killed as a result of incidental interactions with commercial fisheries. It is also not known which fishery may be responsible for the bycatch. Regardless, these data indicate a minimum mortality level of 1.1/year (using bycatch data only) to 2.4/year (using bycatch, stranding, and market data) in the waters of Japan and Korea.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska and Russia have not been reported to take humpback whales from this stock.

HISTORIC WHALING

The number of humpback whales in the North Pacific may have numbered approximately 15,000 individuals prior to exploitation (Rice 1978). Intensive commercial whaling removed more than 28,000 animals from the North Pacific during the 20th century (Rice 1978). This mortality estimate likely underestimates the actual kill as a result of under-reporting of the Soviet catches (Yablokov 1994).

STATUS OF STOCK

The estimated human-related annual mortality rate (~~0.8~~1.0) exceeds the PRB level for this stock (0.7). ~~At least one of the mortalities occurred in a U. S. fishery~~The estimated human-related mortality rate is based solely on mortalities that occurred incidental to commercial fisheries and is higher than the PBR level for this stock; therefore, the estimated fishery mortality and serious injury rate exceeds 10% of the PBR (0.07). The rate cannot be considered insignificant and approaching zero. The humpback whale is listed as "endangered" under the Endangered Species Act, and therefore designated as "depleted" under the MMPA. As a result, the Western North Pacific humpback whale stock is classified as a strategic stock. Reliable population trend data and the status of this stock relative to its Optimum Sustainable Population size are currently unknown. Noise pollution from the U. S. Navy's Low Frequency Active sonar program and other anthropogenic sources (i.e., shipping) is a potential concern as to the health of this stock.

CITATIONS

Baker, C. S., L. M. Herman, A. Perry, W. S. Lawton, J. M. Straley, A. A. Wolman, G. D. Kaufman, H. E. Winn, J. D. Hall, J. M. Reinke, and J. Ostman. 1986. Migratory movement and population structure of humpback whales (*Megaptera novaeangliae*) in the central and eastern North Pacific. Mar. Ecol. Prog. Ser. 31:105-119.

Baker, C. S., S. R. Palumbi, R. H. Lambertsen, M. T. Weinrich, J. Calambokidis, and S. J. O'Brien. 1990. Influence of seasonal migration on geographic distribution of mitochondrial DNA haplotypes in humpback whales. Nature 344:238-240.

Baker, C. S., L. Medrano-Gonzalez, J. Calambokidis, A. Perry, F. Pichler, H. Rosenbaum, J. M. Straley, J. Urban-Ramirez, M. Yamaguchi, and O. von Ziegesar. 1998. Population structure of nuclear and mitochondrial DNA variation among humpback whales in the North Pacific. Mol. Ecol. 7(695-707).

Barlow, J., and P. J. Clapham. 1997. A new birth-interval approach to estimating demographic parameters of humpback whales. Ecol. 78(2):535-546.

Berzin, A. A., and A. A. Rovnin. 1966. The distribution and migrations of whales in the northeastern part of the Pacific, Chukchi and Bering Seas. Izvestiya Tikhookeanskogo Nauchno-Issledovatel'skogo Institut Rybnogo Khozyaistva I Okeanografii 58:179-207. (Translated by Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, Seattle, 1968, pp. 103-136. *In* K. I. Panin (ed.), Soviet Research on Marine Mammals of the Far East.)

Best, P. B. 1993. Increase rates in severely depleted stocks of baleen whales. ICES J. Mar. Sci. 50:169-186.

Brownell, R. L., T. Kasuya, W. P. Perrin, C. S. Baker, F. Cipriano, J. Urban R., D. P. DeMaster, M. R. Brown, and

P. J. Clapham. 2000. Unknown status of the western North Pacific humpback whale population: a new conservation concern. Unpublished report to the International Whaling Commission. 5p.

Calambokidis, J., G. H. Steiger, J. C. Cubbage, K. C. Balcomb III, and P. Bloedel. 1989. Biology of humpback whales in the Gulf of the Farallones. Report to Gulf of the Farallones National Marine Sanctuary, San Francisco, CA by Cascadia Research Collective, 218½ West Fourth Avenue, Olympia, WA. 93 pp.

Calambokidis, J., G. H. Steiger, and J. R. Evenson. 1993. Photographic identification and abundance estimates of humpback and blue whales off California in 1991-92. Final Contract Report 50ABNF100137 to Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038. 67 pp.

Calambokidis, J., G. H. Steiger, J. M. Straley, T. Quinn, L. M. Herman, S. Cerchio, D. R. Salden, M. Yamaguchi, F. Sato, J. R. Urban, J. Jacobson, O. Von Zeigesar, K. C. Balcomb, C. M. Gabriele, M. E. Dahlheim, N. Higashi, S. Uchida, J. K. B. Ford, Y. Miyamura, P. Ladrón de Guevara, S. A. Mizroch, L. Schlender, and K. Rasmussen. 1997. Abundance and population structure of humpback whales in the North Pacific basin. Final Contract Report 50ABNF500113 to Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038. 72 pp.

Darling, J. D. 1991. Humpback whales in Japanese waters. Ogasawara and Okinawa. Fluke identification catalog 1987-1990. Final Contract Report, World Wide Fund for Nature, Japan. 22 pp.

Darling, J. D., and S. Cerchio. 1993. Movement of a humpback whale (*Megaptera novaeangliae*) between Japan and Hawaii. Mar. Mammal Sci. 1:84-89.

Darling, J. D., and D. J. McSweeney. 1985. Observations on the migrations of North Pacific humpback whales (*Megaptera novaeangliae*). Can. J. Zool. 63:308-314.

Darling, J. D., J. Calambokidis, J., K. C. Balcomb, P. Bloedel, K. Flynn, A. Mochizuki, K. Mori, F. Sato, and M. Yamaguchi. 1996. Movement of a humpback whale (*Megaptera novaeangliae*) from Japan to British Columbia and return. Mar. Mammal Sci. 12(2):281-287.

Darroch, J. N. 1961. The two-sample capture-recapture census when tagging and sampling are stratified. Biometrika 48:241-260.

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conserv. Biol. 6:24-36.

Forney, K. A., and R. L. Brownell. 1996. Preliminary report of the 1994 Aleutian Island marine mammal survey. Unpubl. doc. submitted to Int. Whal. Comm. (SC/48/O 11). 15 pp.

Johnson, J. H., and A. A. Wolman. 1984. The humpback whale, *Megaptera novaeangliae*. Mar. Fish. Rev. 46(4):30-37.

Moore, S. E., J. M. Waite, L. L. Mazzuca, and R. C. Hobbs. 2000. Provisional estimates of mysticete whale abundance on the central Bering Sea shelf. J. Cetacean Res. Manag. 2(3):227-234.

Moore, S. E., J. M. Waite, N. A. Friday and T. Honkalehto. 2002. Distribution and comparative estimates of cetacean abundance on the central and south-eastern Bering Sea shelf with observations on bathymetric and prey associations. Progr. Oceanogr. 55(1-2):249-262.

National Marine Fisheries Service. 1991. Recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the humpback recovery team for the National Marine Fisheries Service, Silver Spring, Maryland. 105 pp.

Nemoto, T. 1957. Foods of baleen whales in the northern Pacific. Sci. Rep. Whales Res. Inst. Tokyo 12:33-89.

Nishiwaki, M. 1966. Distribution and migration of the larger cetaceans in the North Pacific as shown by Japanese whaling results. Pp. 172-191, *In* K. S. Norris (ed.), Whales, Dolphins and Porpoises, University of California Press, Berkeley, CA.

Perry, A., C. S. Baker, and L. M. Herman. 1990. Population characteristics of individually identified humpback whales in the central and eastern North Pacific: a summary and critique. Rep. Int. Whal. Comm. (Special Issue 12):307-317.

Rice, D. W. 1978. The humpback whale in the North Pacific: distribution, exploitation and numbers. Appendix 4. Pp. 29-44, *In* K. S. Norris and R. R. Reeves (eds.), Report on a workshop on problems related to humpback whales (*Megaptera novaeangliae*) in Hawaii. U.S. Dep. Commer., Nat. Tech. Info. Serv. PB-280 794. Springfield, VA.

Steiger, G. H., J. Calambokidis, R. Sears, K. C. Balcomb, and J. C. Cubbage. 1991. Movement of humpback whales between California and Costa Rica. Mar. Mammal Sci. 7:306-310.

Tomlin, A. G. 1967. Mammals of the USSR and adjacent countries. vol. 9, Cetacea. Israel Program Sci. Transl. No. 1124, Natl. Tech. Info. Serv. TT 65-50086. Springfield, VA. 717 pp. (Translation of Russian text published in 1957).

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

Waite, J. M., M. E. Dahlheim, R. C. Hobbs, S. A. Mizroch, O. Ziegesar-Matkin, J. M. Straley, L. M. Herman, and J. Jacobsen. 1999. Evidence of a feeding aggregation of humpback whales (*Megaptera novaeangliae*) around Kodiak Island, AK. Mar. Mammal Sci. 15(1):210-219.

Witteveen, B. H. 2003a. Abundance and feeding ecology of humpback whales (Megaptera novaeangliae in Kodiak, Alaska. Masters thesis, University of Alaska. 109p.

Witteveen, B. H. 2003b. A catalogue of western Alaska humpback whales. Unpublished report submitted to the National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA.

Yablokov, A. V. 1994. Validity of whaling data. Nature 367:108.

FIN WHALE (*Balaenoptera physalis*): Northeast Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the U.S. waters in the Pacific, fin whales are found seasonally off the coast of North America and Hawaii, and in the Bering Sea during the summer (Fig. 35). Recent information on seasonal fin whale distribution has been gleaned from the reception of fin whale calls by bottom-mounted, offshore hydrophone arrays along the U.S. Pacific coast, in the central North Pacific, and in the western Aleutian Islands (Moore et. al. 1998; Watkins et al. 2000). Moore et al. (1998) and Watkins et al. (2000) both documented high levels of fin whale call rates along the U.S. Pacific coast beginning in August/September and lasting through February, suggesting that this may be an important feeding area during the winter. While peaks in call rates occurred during fall and winter in the central North Pacific and the Aleutian Islands, there were also a few calls recorded during the summer months. While seasonal differences in recorded call rates are generally consistent with the results of aerial surveys which have documented seasonal whale distribution, it is not known whether these differences in call rates reflect true seasonal differences in whale distribution, differences in calling rates, or differences in oceanographic properties (Moore et al. 1998). Fin whale calls have also been well-documented off of Hawaii during the winter (McDonald and Fox 1999), although aerial and shipboard surveys have found relatively few animals in Hawaiian waters (Mobley et al. 1996).

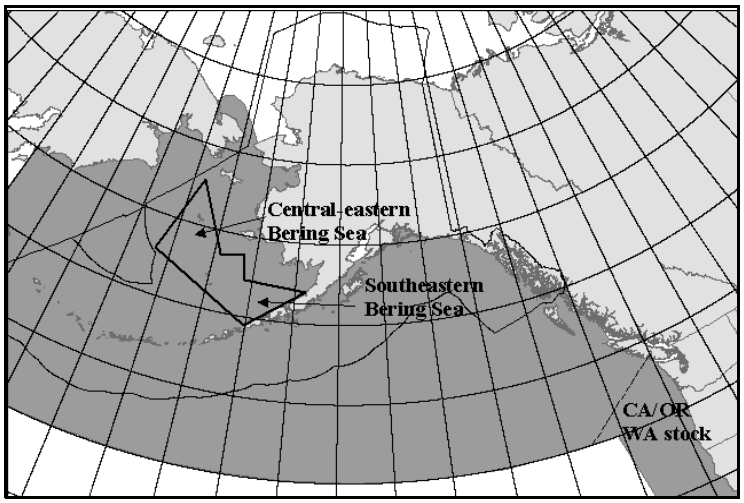

Figure 35. Approximate distribution of fin whales in the eastern North Pacific (shaded area). Enclosed area indicates general location of the 1999 and 2000 pollock surveys in the Bering Sea from which regional estimates of the fin whale population was made.

Recent surveys in the central-eastern and southeastern Bering Sea in 1999 and 2000 resulted in new information about the distribution and relative abundance of fin whales in these areas (Moore et al. 2000; 2002). Fin whale abundance estimates were nearly five times higher in the central-eastern Bering Sea than in the southeastern Bering Sea (Moore et al. 2002), and most sightings in the central-eastern Bering Sea occurred in a zone of particularly high productivity along the shelf break (Moore et al. 2000).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous in winter, possibly isolated in summer; 2) Population response data: unknown; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this limited information, the International Whaling Commission considers fin whales in the North Pacific to all belong to the same stock (Mizroch et al. 1984), although the authors cited additional evidence that supports the establishment of subpopulations in the North Pacific. Further, Fujino (1960) describes an eastern and a western group, which are isolated though may intermingle around the Aleutian Islands. Tag recoveries reported by Rice (1974) indicate that animals wintering off the coast of southern California range from central California to the Gulf of Alaska during the summer months. Fin whales along the Pacific coast of North America have been reported during the summer months from the Bering Sea to as far south as central Baja California (Leatherwood et al. 1982). As a result, stock structure of fin whales is considered equivocal. ~~Based on a conservative management approach, t~~

Three stocks of fin whales are currently recognized: 1) Alaska (Northeast Pacific), 2) California/Washington/Oregon, and 3) Hawaii. The California/Oregon/Washington and Hawaii fin whale stocks are reported separately in the Stock Assessment Reports for the Pacific Region. Catch and Discovery Mark data indicate that fin whales occurring in Alaska waters in the summer may segregate into separate winter areas off the coast of Asia

and off the western U.S. coast (Mizroch et al. in review). If this is the case, then abundance estimates resulting from summer surveys in the Gulf of Alaska or Bering Sea may be of a mixed stock assemblage.

POPULATION SIZE

Reliable estimates of current and historical abundance for the entire Northeast Pacific fin whale stock are currently not available. Ranges of population estimates for the entire North Pacific prior to exploitation and in the early 1970s are 42,000 to 45,000 and 14,620 to 18,630, respectively (Ohsumi and Wada 1974), representing 32% to 44% of the precommercial whaling population size (Braham 1984). These estimates were based on population modeling, which incorporated catch and observation data. These estimates also include whales from the California/Oregon/Washington stock for which a separate abundance estimate is currently available.

Two recent studies provide some information on presence of fin whales, although they do not provide estimates of population size. A survey conducted in August of 1994 covering 2,050 nautical miles of trackline south of the Aleutian Islands encountered only 4 fin whale groups (Forney and Brownell 1996). However, this survey did not include all of the waters off Alaska where fin whale sightings have been reported, thus, no population estimate can be made. Passive acoustics were used off the island of Oahu, Hawaii, to document a minimum density estimate of 0.081 fin whales/1000km^2 from peak call rates during the winter (McDonald and Fox 1999). This density estimate is well below the population density of 1.1 animals/1000km^2 documented off the coast of California (Barlow, 1995; Forney et al. 1995), but does indicate that Hawaii is used seasonally by fin whales.

A visual survey for cetaceans was conducted in the central-eastern Bering Sea in July-August 1999 and in the southeastern Bering Sea in June-July 2000 in cooperation with research on commercial fisheries (Moore et al. 2002). The survey included 1,761 km and 2,194 km of effort in 1999 and 2000, respectively. Aggregations of fin whales were often sighted in 1999 in areas where the ship's echosounder identified large aggregations of zooplankton, euphausids, or fish (Moore et al. 2000). One aggregation of fin whales which occurred during an off-effort period involved greater than 100 animals and occurred in an area of dense fish echosign. Results of the surveys in 1999 and 2000 in the central-eastern Bering Sea and southeastern Bering Sea provided provisional estimates of 3,368 (CV = 0.29) and 683 (CV = 0.32), respectively (Moore et al. 2002). These estimates are considered provisional because they have not been corrected for animals missed on the trackline, animals submerged when the ship passed, and responsive movement. However, the provisional estimate for fin whales in each area is expected to be robust as previous studies have shown that only small correction factors are needed for this species. The Moore et al. (2002) estimate for 1999 is different than that of Moore et al. (2000) because it covers the south-eastern Bering Sea as well as the central-eastern Bering Sea. Additionally, the region covered by Moore et al. (2000) did not have consistent effort and thus could be inaccurate. This estimate cannot be used as an estimate of the entire Northeast Pacific stock of fin whales because it is based on a survey in only part of the stock's range.

Minimum Population Estimate

At this time, it is not possible to produce a reliable estimate of minimum abundance for this stock, as a current estimate of abundance is not available.

Current Population Trend

Reliable information on trends in abundance for the Northeast Pacific stock of fin whales are currently not available. There is no indication whether recovery of this stock has or is taking place (Braham 1992; Perry et al. 1999).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Northeast Pacific fin whale stock. Hence, until additional data become available, it is recommended that the cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the recommended

value for cetacean stocks which are listed as endangered (Wade and Angliss 1997). However, because a reliable estimate of minimum abundance is currently not available, the PBR for this stock is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Prior to 1999, there were no observed or reported mortalities of fin whales incidental to commercial fishing operations within the range of this stock. However, in 1999, one fin whale was killed incidental to the Bering Sea/Aleutian Island groundfish trawl fishery (Table 28). This single mortality results in an estimate of 3 mortalities in 1999, and an average 0.6 (CV =.0.8) mortalities over the 5-year period from 1997 to 2001. Although there have been a few strandings of fin whales recorded in recent years (2 and 1 in 1998 and 1999, respectively; NMFS unpublished data), none of these have been noted as having evidence of fishery interactions.

Table 28. Summary of incidental mortality of fin whales (Northeast Pacific stock) due to commercial fisheries from 1997 to 2001 and calculation of the mean annual mortality rate.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
~~Bering Sea/Aleutian Is. (BSAI)~~Gulf of Alaska groundfish trawl	97~~8~~-0~~1~~2	obs data	~~27-32%~~ 31.8% average effort over 5 yrs	~~0, 0, 1, 0, 0~~ 1 observed in 5 years	~~0, 0, 3, 0, 0~~ 0.6 averaged over 5 years	0.6 (CV = ~~0.8~~xxx)
Estimated total annual mortality						0.6 (CV = 0.8)

The total estimated mortality and serious injury incurred by this stock as a result of interactions with commercial fisheries is 0.6 (CV = 0.8).

Subsistence/Native Harvest Information

Subsistence hunters in Alaska and Russia have not been reported to take fin whales from this stock.

Other Mortality

Between 19~~46~~25 and 1975, 4~~6,032~~7,640 fin whales were reported killed throughout the North Pacific (International Whaling Commission BIWS catch data, February 2003 version, unpublished), although newly revealed information about illegal Soviet catches indicates that the Soviets over-reported catches of about 1,200 fin whales, presumably to hide catches of other protected species (Doroshenko 2000). In 2000, a fin whale was struck by a vessel in Uyak Bay. Assuming this was the only ship strike which occurred during the 5-year period from 1997 to 2001, the average number of ship strikes per year is 0.2. Thus, the total estimated mortality and serious injury incurred by this stock is 0.8.

STATUS OF STOCK

The fin whale is listed as "endangered" under the Endangered Species Act of 1973, and therefore designated as "depleted" under the MMPA. As a result, the Northeast Pacific stock is classified as a strategic stock. Reliable estimates of the minimum population size, population trends, PBR, and status of the stock relative to its Optimum Sustainable Population size are currently not available. The estimated annual rate of human-caused mortality and serious injury seems minimal for this stock; however, because of the estimated annual take of 0.6 animals, the minimum estimated mortality and serious injury cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. There are no known habitat issues that are of particular concern for this stock.

CITATIONS

Barlow, J. 1995. The abundance of cetaceans in California waters. Part 1: Ship surveys in summer and fall of 1991. Fish. Bull. 93:1-14.

Braham, H. 1984. The status of endangered whales: an overview. Mar. Fish. Rev. 46(4):2-6.

Braham, H. 1992. Endangered whales: Status update. Working document presented at a Workshop on the Status of California Cetacean Stocks (SOCCS/14). 35 pp. + tables. (available upon request - Alaska Fisheries Science Center, 7600 Sand Point Way, NE, Seattle, WA 98115).

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conserv. Biol. 6:24-36.

Doroshenko, N. V. Soviet whaling for blue, gray, bowhead and right whales in the North Pacific Ocean, 1961-1979. In: Soviet whaling data (1949-1979). Eds: Yablokov, A. V. and Zemsky, V. A. Center for Russian Environmental Policy, Marine Mammal Council, Moscow, 96-103.

Forney, K. A., and R. L. Brownell. 1996. Preliminary report of the 1994 Aleutian Island marine mammal survey. Unpubl. doc. submitted to Int. Whal. Comm. (SC/48/O 11). 15 pp.

Forney, K. A., J. Barlow, and J. V. Carretta. 1995. The abundance of cetaceans in California waters. Part II: Aerial surveys in winter and spring of 1991 and 1992. Fish. Bull. 93:15-26.

Fujino, K. 1960. Immunogenetic and marking approaches to identifying sub-populations of the North Pacific whales. Sci. Rep. Whales Res. Inst., Tokyo 15:84-142.

Leatherwood, S., R. R. Reeves, W. F. Perrin, and W. E. Evans. 1982. Whales, dolphins, and porpoises of the eastern North Pacific and adjacent Arctic waters: a guide to their identification. U.S. Dep. Commer., NOAA Tech. Rep. NMFS Circular 444, 245 pp.

Mizroch, S. A., D. W. Rice, and J. M. Breiwick. 1984. The fin whale, *Balaenoptera physalis*. Mar. Fish. Rev. 46(4):20-24.

Mizroch, S. A., D. Rice, D. Zwiefelhofer, J. Waite, and W. Perryman. In review. Distribution and movements of fin whales in the North Pacific Ocean.

McDonald, M. A. and C. G. Fox. 1999. Passive acoustic methods applied to fin whale population density estimatation. J. Acoust. Soc. Am. 105(5):2643-2651.

Mobley, Jr., J. R., M. Smultea, T. Norris, and D. Weller. 1996. Fin whale sighting north of Kaua'i, Hawai'i. Pacific Science. 50(2):230-233.

Moore, S. E., K. M. Stafford, M. E. Dahlheim, C. G. Fox, H. W. Braham, J. J. Polovina, and D. E. Bain. 1998. Seasonal variation in reception of fin whale calls at five geographic areas in the North Pacific. Mar. Mamm. Sci. 14(3):617-627.

Moore, S. E., J. M. Waite, L. L. Mazzuca, and R. C. Hobbs. 2000. Provisional estimates of mysticete whale abundance on the central Bering Sea shelf. J. Cetacean Res. Manag. 2(3):227-234.

Moore, S. E., J. M. Waite, N. A. Friday and T. Honkalehto. 2002. Distribution and comparative estimates of cetacean abundance on the central and south-eastern Bering Sea shelf with observations on bathymetric and prey associations. Progr. Oceanogr. 55(1-2):249-262.

Ohsumi, S., and S. Wada. 1974. Status of whale stocks in the North Pacific. 1972. Rep. Int. Whal. Comm. 24:114-126.

Perry, S. L., D. P. DeMaster, and G. K. Silber. 1999. The Great Whales: History and Status of Six Species Listed as Endangered under the U.S. Endangered Species Act fo 1973. Mar. Fish. Rev. 61(1)

Rice, D. W. 1974. Whales and whale research in the eastern North Pacific. Pp. 170-195, *In* W. E. Schevill (ed.), The whale problem: A status report. Harvard Press, Cambridge, MA.

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

Watkins, W. A., M. A. Daher, G. M. Reppucci, J. E. George, D. L. Martin, N. A. DiMarzio, and D. P. Gannon. 2000. Seasonality and distribution of whale calls in the North Pacific. Oceanography. 13(1):62-67.